Incidental Appendectomy—Yes or No? A Retrospective Case Study and Review of the Literature

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ABSTRACT

Objective: A retrospective review of appendectomies performed at the University of Kansas Medical Center between January 1, 1989, and January 1, 1994, was conducted. In addition, the literature evaluating effectiveness of incidental appendectomy in preventing future operation and morbidity from appendicitis was reviewed. The results of the two reviews were analyzed to formulate guidelines for the appropriateness of performing incidental appendectomy in association with other operative procedures.

Method: A retrospective review of results of appendectomies performed in 460 patients at the University of Kansas Medical Center with analysis of operative findings, pathology of the removed appendix and operative complications was performed. These results were compared with those of a systematic review of the literature utilizing a Medline search relating to the subject of incidental appendix removal.

Results: Two hundred sixty-one incidental appendectomies were performed in this study of 460 patients (60%). The procedure was most commonly performed with total abdominal hysterectomy (56%), followed by oophorectomy (15%) and exploratory laparotomy (11%). Morbidity was minimal at all ages. Microscopic pathology was found in 25% of the cases.

Conclusion: The data from the current survey and literature review support incidental removal of the appendix in the young patient (<35 years old). In patients 35–50 years old the literature is controversial, and the patient's clinical condition and judgment of the operating surgeon should determine whether incidental appendectomy should be performed. However, routine incidental appendectomy cannot be justified in patients greater than age 50. Infect. Dis. Obstet. Gynecol. 6:30–37, 1998. © 1998 Wiley-Liss, Inc.

INTRODUCTION

Incidental appendectomy has been a subject of controversy for many years. Various authors have argued that incidental removal of the appendix at the time of another operation incurs minimum morbidity and prevents future morbidity/mortality. On the other hand, others have stated that operative time is increased if the operation serves no useful purpose, and the operation may increase morbidity in some cases. The purpose of this retrospective study and review of the literature is to examine the characteristics of appendectomies performed at the University of Kansas Medical Center and compare these results with those noted in the literature.

SUBJECTS AND METHODS

Of the records of 460 patients who had appendectomy at the University of Kansas Medical Center (between January 1, 1989, and January 1, 1994), 432

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Case Report

were reviewed retrospectively. The records were examined for age at occurrence, primary diagnosis, and postoperative parameters.

RESULTS

Two hundred sixty-one patients (60%) underwent incidental appendectomy. One hundred seventy-one (39%) were performed for a primary diagnosis of appendicitis, and 110 (64%) of these had the diagnosis of appendicitis confirmed by pathology. The mean age for pathologically confirmed appendicitis was 29.5 years, and the median age was 26 years. In 59% of cases, patients were less than 30 years old, and only 11% were older than age 50. The mean age at which the appendix was removed for a diagnosis of appendicitis without a pathologic diagnosis of appendicitis was 27.9 years, with a median age of 25 years for all patients. Sixty-nine percent of patients were less than 30 years old, and only 5% were greater than age 50. Incidental appendectomy was performed more often in older females. The mean age for female patients was 40 years, 71% were greater than 30 years old, and 23% were greater than 50. The most common surgical procedure accompanied by incidental appendectomy at the medical center was total abdominal hysterectomy (56%). Other concomitant procedures were oophorectomy or salpingectomy (15%), exploratory laparotomy for other reason (11%), bowel surgery (6%), radical hysterectomy (3%), and cholecystectomy (1%).

The average postoperative stay for incidental appendectomy was 7.1 days versus 5.0 days for surgically confirmed appendicitis and 4.8 days for laparotomy performed for a diagnosis of appendicitis without pathologic findings. The influence of appendectomy on the length of postoperative stay and operative time in these cases was difficult to analyze secondary to the diversity of operations performed. The average time of operation including incidental appendectomy was 192 minutes versus 97 minutes for primary appendectomies. Complications included blood transfusion, abscess, febrile morbidity, postoperative ileus, and incisional infection. Patients who underwent extensive operation, i.e. radical hysterectomy, splenectomy, and nephrectomy, had a greater incidence of blood transfusion.

Twenty-three percent of appendices removed

incidentally in this study had demonstrable pathology. Findings included the following: metastatic cancer—5%, acute serositis—2%, carcinoid—1%, endometriosis—1%, fecolith—.5% and fibrinous obliteration—9%. Of the 61 appendices removed for a clinical diagnosis of appendicitis when no clinical appendicitis was noted, 25% had demonstrable pathology. Fibrous obliteration occurred in 10%, lymphoid hyperplasia in 5%, fecolith in 3%, carcinoid in 2%, and others, 5%.

DISCUSSION

The debate over incidental appendectomy is not new. In 1902, H.A. Kelly polled 80 prominent American surgeons regarding this operation.[1] Thirty (37%) replied they routinely performed incidental appendectomy and 72 (90%) agreed that incidental appendectomy should be performed if the appendix were adherent to surrounding structures. Kelly argued against removing the appendix, commenting on increased operative risk, unknown statistical advantage of the operation, and the unknown function of the appendix. Since these early reports, other authors have expressed a more liberal approach. Moertel[2] summarized his feelings: "The vermiform appendix has been considered singularly devoid of any useful function. The privilege of its amputation has rewarded many a fledgling physician for his patient pulling of retractors." Acute appendicitis has been attributed to a variety of causes, including mechanical obstruction, inadequate dietary fiber, familial susceptibility, and various bacterial and viral conditions.[3]

Proponents of incidental appendectomy cite technical ease and low morbidity of the procedure, no additional risk in anesthesia, high incidence of disease found in specimens, and elimination of confusion over future conflicting diagnosis.[4] Opponents counter that transecting an organ containing feces in an otherwise clean procedure violates sound surgical principles and increases operative time and morbidity.

The following points need to be considered prior to formulating any guidelines regarding incidental appendectomy: 1) incidence of appendicitis, 2) function of the appendix and relation to potential future unrelated disease, 3) morbidity associated with incidental appendectomy, 4) cost of in-

cidental appendectomy, and 5) pathology noted in the appendices removed incidentally.

Addiss[3] analyzed National Hospital Discharge Survey Data for the years 1979–1984. This study utilized the following definitions: 1) "primary appendectomy:" nonincidental appendectomy, 2) "primary positive appendectomy:" a discharge diagnosis of acute appendicitis, 3) "primary negative appendectomy:" appendectomy performed, but no discharge diagnosis of acute appendicitis (possible chronic or recurrent appendicitis), and 4) "incidental appendectomy:" appendectomy was completed at the time of another primary procedure. Between 1979 and 1984, approximately 3.4 million appendectomies were performed in the United States, approximately 561,000 cases per year or an annual incidence of 26 per 10,000 population. Of these, 53% were primary operations for a diagnosis of appendicitis. Eighty-five percent of these cases yielded specimens consistent with appendicitis (primary positive). This results in an incidence of acute appendicitis of 11 cases per 10,000 population per year. Forty-seven percent of the total appendectomies were incidental, giving an annual rate of incidental appendectomy of 12 per 10,000 population per year.

The case–fatality ratio for both primary positive and primary negative cases was 0.3%. The case–fatality ratio for patients greater than 65 years old with primary positive appendectomy was 4.6%, but only 0.2% in patients less than 65 years of age. Therefore, having an operation for presumed appendicitis at an older age increases the morbidity and mortality, as would be expected.

Primary Positive Appendectomy (Acute Appendicitis Confirmed on Pathology Report)

The age-specific incidence of acute appendicitis follows a similar pattern for males and females, but males have a higher rate at all ages, with an overall male:female ratio of 1.4:1.0. The incidence is highest in males age 10–14 years old and in females 15–19 years. In persons greater than 45 years old, the rates remain relatively constant at approximately 6/10,000 population per year for males and 4/10,000 for females. The median age for both males and females with a positive primary appendectomy was 21 years old, and 69% of people with appendicitis were less than 30 years old.

Primary Negative Appendectomy (No Pathology in Appendix)

The incidence of primary negative appendectomy was higher in females, with the highest rate among women of reproductive age. The rate of negative appendectomy among females 15–24 years old was 2.5 times higher than that for males of the same age.

Overall, the diagnostic accuracy was lower for females (78.6%) than for males (91.2%). The diagnostic accuracy dropped sharply during the reproductive years for females, while there was no appreciable change with age in males. The incidence of gynecologic conditions involving the adnexa during reproductive age in females is probably important in these findings. These conclusions are confirmed by Borgstein et al.[5] who reviewed 161 female patients <age 50 diagnosed with appendicitis in which diagnostic laparoscopy was performed prior to laparotomy. Results were compared with 42 similar patients who did not have laparoscopy, as well as 23 postmenopausal women and 137 males. In 23% of the patients, a gynecological diagnosis was found at the time of laparoscopy. The negative appendectomy rate after laparoscopy was 5%, compared with 38% in the group who underwent operation directly. The study suggested that diagnostic laparoscopy would significantly reduce the negative appendectomy rate in reproductive-age women.

Incidental Appendectomy

The incidence of incidental appendectomy was 6.6 times higher in females than in males (62.6% versus 17.7%).

Women 35–44 years old had the highest rate of incidental appendectomy (approximately 43.8/10,000 population per year) and were 12.1 times more likely to have an incidental appendectomy than men. The annual rate of incidental appendectomy in men gradually increased with age to a rate of 7.3/10,000 population per year among men greater than 65 years of age. The median age for incidental appendectomy in women was 34 years and for men 47 years.

Surgical procedures most commonly performed at the time of incidental appendectomy on females

were the following: 1) total abdominal hysterectomy—45%, 2) oophorectomy or salpingectomy—37.5%, 3) cholecystectomy—18.4%, 4) excision of ovarian tissue—7.2%, 5) cesarean delivery—4.9%. In males the most common surgical procedures were as follows: 1) cholecystectomy—36.6%, 2) total/partial bowel excision—11.8%, 3) inguinal hernia repair—4.9%.

Appendiceal perforation occurred in 19.2% of cases of appendicitis in males and 17.8% of females. The perforation rate was lowest in persons aged 20–24 years (91%) and increased to 51% in persons aged 65 years or greater. The rate of appendicitis was increased for white versus nonwhite race, although perforation rates and diagnostic accuracy were similar. The incidence of appendicitis was highest in the north central United States and lowest in mid-Atlantic states. Finally, the incidence of appendicitis appeared to increase during the summer months.

Assuming a constant incidence of appendicitis and appendectomy at 1979–1984 levels, the lifetime risk for a child age less than 5 years of having an appendectomy (primary or incidental) is 12% for males and 23.1% for females. The lifetime risk for appendicitis is 8.6% for males and 6.7% for females. The lifetime risk for an incidental appendectomy was 2.9% for males and 16.0% for females. The preventive value of each incidental appendectomy performed in different age groups can be estimated from life tables. One thousand incidental appendectomies could be expected to prevent 52 cases of appendicitis in females 15–19 years of age, 24 cases in females 35–39 years of age, and 8 cases in females 60–64 years of age. However, most incidental appendectomies are performed in patients over the age of 35, which is past the age of greatest risk of appendicitis and affects females who appear to be at lower risk than males of comparable age.

In the cases reviewed, using a life table model that is age adjusted, 260,000 appendectomies performed on persons less than 75 years old would prevent an estimated 7,300 future lifetime cases of acute appendicitis which translates to 36 incidental appendectomies for each case of appendicitis prevented.

Therefore, the appropriate surgical question should not be whether incidental appendectomy prevents future appendicitis, but whether the procedure should be performed in persons at low risk for appendicitis.

Costs of Incidental Appendectomy as a Preventive Measure

Sugimoto and Edwards[6] looked at the statewide hospital discharge data in South Carolina from 1979–1981 to evaluate the effectiveness of incidental appendectomy performed as a preventive measure. They observed the occurrence of incidental appendectomy to exceed that of appendicitis, with population-based rates of 1.13/1,000 person–years for incidental appendectomy at .97/1,000 for appendicitis. Greater than 64% of appendicitis cases occurred in persons less than 25 years of age, and greater than 75% of the incidental appendectomies occurred in persons older than 25 years of age. Their data suggest that 254,250 incidental appendectomies performed in this country yearly might prevent 3,382 future cases of appendicitis. Costs are difficult to estimate because some surgeons charge a full fee and others only a partial fee, while yet others charge no fee at all to perform the operation. Cost estimates were based on the average estimated surgeon's fee at the time of $800 and an average hospital cost of $1,200.

The cost of prevented cases was estimated as $6,764,000, while the cost of incidental appendectomy would be $20,340,000 if as many as 10% of the surgeons' fees were separately charged. Therefore, approximately $20 million would be potentially spent to save $6 million. In addition, the study indicated that 75% of incidental appendectomies were performed on females greater than 25 years old, a population which is past the peak occurrence of appendicitis. Approximate physician fees at the University of Kansas in 1994 were $700 for incidental appendectomy and $1,100 for primary appendectomy.

Morbidity of Incidental Appendectomy

When discussing the morbidity associated with incidental appendectomy, opinions vary considerably; however, most reports reviewing this topic are based on retrospective, uncontrolled trials.

Lowery and Lenhardt[7] reviewed 368 consecutive biliary tract procedures, 116 of which included incidental appendectomy. Operative time, length

of hospital stay, and postoperative complications were comparable for both groups.

Shumake[8] reviewed a small series of 11 appendectomies performed at the time of right inguinal herniorrhaphy and reported no postoperative wound infections or recurrent hernias.

Wilson et al.[9] reviewed experiences with appendectomy performed concurrently during cesarean delivery and various postpartum sterilization procedures. Appendectomy was performed in 37 of 206 patients who were undergoing cesarean delivery alone, in 28 of 123 who were undergoing cesarean delivery with tubal ligation, in 22 of 57 who were having abdominal hysterectomy, and in 41 of 354 with postpartum tubal ligation. In none of these groups was there any difference with respect to length of postoperative hospital course, transfusion requirements, or the incidence of febrile morbidity.

In contrast, Pollock and Evans[10] compared the incidence of septic complications after cholecystectomy alone with that of cholecystectomy with concomitant incidental appendectomy in a prospective, randomized trial of parenterally administered prophylactic antibiotics. The decision for appendectomy was not randomized. Patients with prophylactic antibiotics demonstrated a 10% incidence of wound sepsis without appendectomy and 9% with appendectomy. However, infection rates were 16% and 40%, respectively, with and without prophylactic antibiotic protection. The authors felt the addition of appendectomy increased the risk of abdominal wall contamination and, in the absence of effective antibiotic prophylaxis, the risk of sepsis.

Warren et al.[11] reviewed the addition of incidental appendectomy to cholecystectomy in elderly Medicare patients, who have a lower rate of appendicitis but higher morbidity when it occurs. Approximately 9,000 patients who had incidental appendectomy were compared with 44,000 who did not have appendectomy. The incidence of wound infection was 83% higher in the group that had appendectomy. In addition, the risk for other adverse outcomes was significantly higher in the cholecystectomy/appendectomy group, although not statistically significant. The authors calculated it would require 115 incidental appendectomies to prevent one case of appendicitis and 4,472 procedures to prevent one future death from appendicitis.

A prospective study was performed by O'Malley et al.,[12] who reviewed 120 patients under age 50 years who were randomized to either cholecystectomy alone or cholecystectomy and appendectomy. There was no difference in the incidence of wound infection in the cholecystectomy-alone group (5.3%) or the group in which appendectomy was added (3.8%). The authors felt incidental appendectomy was a safe addition to elective cholecystectomy.

A retrospective study by Strom et al.[13] at Grady Memorial Hospital of all incidental appendectomies performed during laparotomy for trauma when no intraperitoneal injury could be found had the opposite outcome. In this study the authors found a significant increase in morbidity when incidental appendectomy was performed, compared with those laparotomies without appendectomy. This led to a prospective randomized trial of 184 patients who had no intraperitoneal injury at the time of laparotomy for trauma. Forty-five patients were excluded, as the appendix was not easily exposed, 56 underwent incidental appendectomy, and 83 patients were controls (no appendectomy). The authors found no significant difference in the infection rates among the three groups, and no difference was noted in hospital stay, with an average of 7 days for all groups.

Voith and Lowry[14] reviewed 853 operations in a small hospital in Ontario, Canada, performed between 1981 and 1984 and compared the operative results of the 35% who underwent elective appendectomy with the remainder. Parameters examined included operative time, postoperative stay, fever, intravenous fluids, and infection complications. The addition of appendectomy did not alter any variable for any individual surgeon or the group as a whole. The authors concluded incidental appendectomy protects against future appendicitis and does not alter the outcome of hysterectomy or cholecystectomy.

Finally, Morris et al.[15] retrospectively reviewed the results of 210 patients who underwent staging laparotomy for Hodgkin's disease. One hundred and thirty patients had elective appendectomy as part of the procedure. Of these patients, 5.3% de-

veloped a wound infection following surgery. This incidence was not statistically significantly different from those who did not have appendectomy. The authors, however, concluded that while not significant, routine removal of the appendix was not justified in an attempt to prevent future appendicitis.

These studies demonstrate the problem with retrospective reports: bias in case selection, variances in chart documentation, inconsistent interpretation of data obtained at a remote time, and multiplicity of uncontrolled variables. The study performed by Strom et al.[13] at Grady Memorial Hospital appears to support the theory that incidental appendectomy can be a relatively safe procedure in an appropriately selected patient.

Function of the Appendix

The decision for elective appendectomy is usually based on the premise that the appendix is a vestigial, functionless organ. However, some authors hypothesize the lymphoid tissue of the appendix may exert a protective function against virus and tumor antigens. McVay[16] analyzed 820 autopsies and showed a positive correlation between appendectomy and subsequent development of cancer with a P value of less than 0.0003. Numerous other investigators have also reviewed this theory with *retrospective* studies. Approximately equal numbers of investigators have shown a causal relationship between appendectomy and the subsequent development of cancer as those that show no relationship.

In 1974, Moertel et al.[2] published a *prospective* study of 1,779 patients in Rochester, Minnesota, all of whom were over the age of 40 years. Comparing the observed and expected rates of cancer in patients who had undergone appendectomy versus the control group, he demonstrated no apparent predisposition for the development of cancer in those patients who had undergone appendectomy. This is the only large prospective study available and may suggest the answer to the question of a possible relationship of appendectomy to cancer.

Pathology in Appendices

Additional support for the elective removal of the appendix comes from the frequent notation of ab-

normal pathologic findings in an otherwise normal appearing appendix.

Melcher,[17] reported that of 45 appendices removed electively at hysterectomy, only 12 (27%) were normal histologically, whereas 12 (27%) others contained intraluminal purulent material, and another 16 (35%) demonstrated increased fibrous tissue projections that had led to either partial or complete obliteration of the appendiceal lumen. Two contained carcinoid tumors, one contained a mucocele, one contained melanosis coli, and one contained a refractile material of uncertain clinical significance.

Arnbjörnsson[18] stated one of the strongest arguments for incidental appendectomy lies in the high percentage of varied abnormalities found in the appendices. A chart review of 2,974 appendectomies performed between 1969 and 1979 showed 103 were incidental. Pathology review was completed on all specimens, with 28% of the incidental appendectomies being abnormal. Those reports indicate that there is a variable incidence (16–73%) of abnormal pathologic findings in appendices presumed to be normal at the time of surgery. There are no studies to determine how many microscopically abnormal appendices would have later produced symptoms.

Waters[19] reviewed a series of 830 elective appendectomies performed at the time of laparotomy for other intraabdominal disease. Four hundred of these procedures were performed in 1,042 patients undergoing abdominal hysterectomy, for an incidence of 47% that increased to 57% if patients with previous appendectomy were excluded. It was felt significant that 22% (148) of the appendices showed pathologic changes that would have justified removal if the patient had symptoms. Only one case was accompanied by a complication that may have been related to the performance of the appendectomy. The authors concluded that elective appendectomy should be performed with abdominal and pelvic surgery "whenever the opportunity is presented," within limits of standard clinical judgment.

CONCLUSION

The relative safety of incidental appendectomy has been demonstrated by several reviews. Is the fact that a grossly healthy appearing appendix may be

abnormal sufficient reason for performing this operation?

The question of appropriate surgical policy may not be does incidental appendectomy prevent future appendicitis, but whether the procedure should be performed in persons at low risk. At least two different ages, less than 35 and greater than 60 have been proposed as ages to restrict incidental appendectomies. According to data reviewed by Addiss[3], using life tables that were discussed earlier, limiting incidental appendectomies to persons less than 35 years old would reduce the total number of incidental procedures in the United States by 50% (130,000 operations) but might result in as many as 2,200 additional lifetime cases of appendicitis, including 880 appendiceal perforations. In contrast, limiting incidental appendectomy to persons less than 60 years of age would reduce the number of procedures by 8% (20,800) and result each year in an additional 130 lifetime cases of appendicitis (64 with perforations). To prevent a single lifetime case of acute appendicitis in persons aged 35 to 60 years, 59 and 166 incidental procedures would be required, respectively.

The review of the literature clearly shows that morbidity associated with incidental appendectomy is minimal. Also, the high incidence of pathologic abnormalities found in incidentally removed appendices tends to substantiate the opinion of those who advocate incidental appendectomy.

In general, incidental appendectomy appears to be a series to the patient, involving minimal complications if the patient is young. Nonetheless, the decision to perform an incidental appendectomy must be tempered by sound surgical judgment and must take into consideration the patient's age. Relative contraindications include seriously ill patients, patients who are under therapy with immunosuppressive agents, and those with vascular grafts or other foreign bodies.

In patients 10–30 years of age (the group associated with the highest incidence of appendicitis) who are otherwise healthy, incidental appendectomy is effective in preventing morbidity and death rate associated with acute appendicitis.[20] In patients 30–50 years of age, incidental appendectomy should be left to the discretion of the surgeon. In patients greater than 50 years of age, the incidence of acute appendicitis decreases and the risk associated with operations and prolonged anesthesia is such that an incidental appendectomy is not beneficial.[20–22] Mentally handicapped patients less than 50 years of age who are physically healthy should have incidental appendectomy at the time of other laparotomies. Patients undergoing procedures that may compromise access to the appendix in the future should undergo incidental appendectomy.[20]

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